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CHEMICAL INSECTICIDES: FIELD EVALUATION FOR CONTROL OF CABBAGE CATERPILLARS

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CHEMICAL INSECTICIDES: FIELD EVALUATION FOR CONTROL OF CABBAGE CATERPILLARS

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INTRODUCTION

In 1970 Creighton, McFadden, and Cuthbert² reported the results obtained in 1966-68 field experiments in which 23 previously untested compounds were evaluated in the spring and fall to determine their effectiveness against the cabbage looper, *Trichoplusia ni* (Hübner). In the spring and fall of 1969-70 additional tests were conducted with chemicals to determine their efficacy against not only the cabbage looper, but also three associated species of lesser economic importance: the imported cabbageworm, *Pieris rapae* (L.), the diamondback moth, *Plutella xylostella* (L.), and the fall armyworm, *Spodoptera frugiperda* (J. E. Smith). The results obtained in these tests are reported in this paper.

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² Creighton, C. S., McFadden, T. L., and Cuthbert, R. B., II. 1970. Field experiments on insecticidal control of cabbage loopers. U.S. Dep. Agric. Prod. Res. Rep. No. 117, 6 pp.

METHODS

The tests were conducted at the Clemson University Truck Experiment Station. Each of the experimental treatments was replicated four to six times on single 3- by 50-ft rows of cabbage plants in randomized blocks. The compounds were applied as sprays with a hand-operated knapsack sprayer at the rate of 50 gal/acre. The sides and tops of the plants were sprayed when the foliage was dry and the wind velocity was less than 4 mi/h; six applications were made at 7-day intervals each spring beginning in late April and extending to early June; seven applications were made at 7-day intervals in the fall, beginning in late September and extending to mid-November.

The effectiveness of the compounds was determined by counting and recording the number of surviving caterpillars of each species found on 10 plants per replicate during each of at least three samplings; also, the extent of injury to the marketable part of the plant at harvest was estimated by

the method of Reid.³ Uninjured plants (head and four wrapper leaves free of all feeding) were put in Class 1; plants with some caterpillar injury but eligible to U. S. Grade 1 were put in Class 2; and damaged plants (head and four wrapper leaves have extensive feeding and ineligible to U. S. Grade No. 1) were put in Class 3.

NEW PROPRIETARY MATERIALS TESTED

Cela K-673—*O*-[2,5-dichloro-4-(methylthio) phenyl] *O*-ethyl methylphosphonothioate
 Cela S-2957—*O*-[2,5-dichloro-4-(methylthio) phenyl] *O*,*O*-diethyl phosphorothioate
 Esso ER 6624—*O*-ethyl *S*-[2-(methylthio) propyl] *S*-propylphosphorodithioate
 Esso ER 6622—*O*-ethyl *S*-propyl *S*-[2-(propylthio) propyl] phosphorodithioate (crude)
 Fundal—*N'*-(4-chloro-*o*-tolyl)-*N*,*N*-dimethylformamidine
 Galecron—*N'*-(4-chloro-*o*-tolyl)-*N*,*N*-dimethylformamidine
 Hercules 17884—*O*,*O*-dimethylphosphorothioate ester, *S*-ester with 3-(mercaptomethyl)-2,4-thiazolidinedione
 Methomyl—*S*-methyl *N*-[(methylcarbamoyl) oxy] thioacetimidate
 Mobil Mc 3470—2,2-dichloro-1-pyrazol-1-ylvinyl diethyl phosphate
 Phosvel—*O*-(4-bromo-2,5-dichlorophenyl) *O*-methyl phenylphosphonothioate

Resmethrin—(5-benzyl-3-furyl) methyl *trans*-(+)-2,2-dimethyl-3-(2-methylpropenyl) cyclopropanecarboxylate
 Shell SD 15289—ethyl *N*-[(methylcarbamoyl) oxy] acetimidate
 Shell SD 15289—ethyl *N*-carbamoyl oxy] thioacetimidic acid ester with mercaptoacetoneitrile
 Shell SD 17250—*N*-[(methylcarbamoyl) oxy] thioacetimidic acid ester with 3-mercaptopropionitrile
 Stauffer N-2596—*S*-(*p*-chlorophenyl) *O*-ethyl ethylphosphonodithioate
 Stauffer R-15792—*S*-(*p*-chlorophenyl) *O*-isobutyl ethylphosphonodithioate

RESULTS

Spring Tests

Results of spring treatments are summarized in table 1. In 1969 each of the compounds tested gave adequate control of relatively light populations of the diamondback moth and the imported cabbage-worm. Monitor applied at three-fourths lb/acre controlled the cabbage looper effectively. In comparison, one-half lb/acre of Fundal and Galecron were as efficient as Monitor in reducing cabbage loopers and Class 3 plants; however they did not produce as many Class 1 plants. Although Shell SD 16898 produced as many marketable cabbage heads as Monitor, Fundal, and Galecron, it did not reduce the cabbage looper population as much, nor did it produce as many Class 1 plants. Cela K-673,

³ Reid, W. J., Jr. 1940. A system of classifying cabbage according to the extent of caterpillar injury. U.S. Dep. Agric. Bur. Ent. and Plant Quar. ET-160, 7 pp.

Cela S-2957, Hercules 17884, Naled, Shell SD 17250, Stauffer N-2596, and Stauffer R-15792 failed to control the cabbage looper.

In 1970 all test compounds controlled light populations of the diamondback moth and the imported cabbageworm well. Esso ER 6624, Esso ER 6622, Fundal, Galecron, Resmethrin, and Phosvel controlled the cabbage looper effectively; these compounds gave as good looper reduction and plant protection as a standard mixture of endosulfan and parathion. Mobil M^c 3470 at 1 lb/acre did not produce as many Class 1 plants as the other compounds; however, it was as good in reducing cabbage loopers and the number of Class 3 plants. A 1½-lb/acre dosage of Phosvel was as good as a 1 lb/acre dosage in killing the caterpillars and protecting the plants from feeding.

Fall Tests

Results of fall treatments are summarized in table 2. In 1969, effective protection against light populations of the cabbage looper and the fall armyworm were obtained with endosulfan. Fundal, methomyl, Monitor, Phosvel, and Shell SD 15289. The plant protection and caterpillar reduction were as good as that provided by a standard mixture of endosulfan and parathion. Galecron at one-fourth lb/acre provided as good plant protection as one-half lb/acre of Fundal, but did not pro-

duce as many Class 1 plants as the other treatments. Methomyl gave as good plant protection and caterpillar reduction at one-half lb/acre as it did at 1 lb/acre.

In 1970 one-half lb/acre of Fundal, Galecron, and Phosvel effectively controlled light populations of the cabbage looper and the fall armyworm; the plant protection provided by these compounds and 0.4lb/acre of Resmethrin was outstanding and equalled the standard mixture of endosulfan and parathion. Mobil M^c 3470 was inferior to all other treatments in reducing loopers and in producing Class 1 plants; it was also inferior to all treatments except Galecron in reducing the number of Class 3 plants.

SUMMARY

Five chemicals that looked promising earlier (Monitor, Methomyl, Fundal, Galecron, and Shell SD 15289) were again found effective against the entire complex of caterpillars. Of 12 treatments that were tested for the first time, Phosvel was outstanding and Mobil 3470 and Resmethrin were promising. Esso ER 6622, ER 6624, and Shell SD 16898 appeared promising against the cabbage looper, the diamondback moth, and the imported cabbageworm but they were not tested against the fall armyworm. The remaining treatments did not appear promising because they failed to control the cabbage looper, which is an important species.

TABLE 1.—*Effectiveness of chemical insecticides in controlling caterpillars on the spring cabbage crop*¹

Insecticide and formulation	Dose, lb/ acre	Cabbage looper 2		Diamondback moth 2		Imported cabbageworm 2		% plants 3 in—		Marketable heads, %
		Number surviving	Reduction, %	Number surviving	Reduction, %	Number surviving	Reduction, %	Class 1 (uninjured)	Class 3 (damaged)	
1969 TEST										
Cela K-673 (100% tech)	1.0	61bc	61	1a	97	0a	100	0e	61c	39
Cela S-2957 (100% tech)	1.0	63bc	60	1a	95	0a	100	0e	63c	37
Fundal (97% SP) 4	.5	8a	95	3a	85	1a	95	46b	6a	94
Galecron (4 lb/gal EC)	.5	9a	94	0a	100	0a	100	50b	7a	38
Hercules 17884 (2 lb/gal EC)	1.0	88bc	44	2a	92	0a	100	0e	62c	38
Monitor (4 lb/gal EC)	.75	3a	98	0a	100	0a	100	87a	0a	100
Naled (8 lb/gal EC)	2.0	81bc	49	0a	100	0a	100	0e	73c	27
Shell SD 16898 (2 lb/gal EC)	1.0	63bc	60	1a	95	0a	100	30c	6a	94
Shell SD 17250 (2 lb/gal EC)	1.0	105c	33	4a	82	1a	95	5de	29b	71
Stauffer N-2596 (7.5 lb/gal EC)	1.0	67bc	58	1a	97	1a	90	6de	32b	68
Stauffer R-15792 (2 lb/gal EC)	1.0	46b	71	2a	92	0a	100	12d	26b	74
Untreated	-	158d	-	22b	-	11b	-	0e	97d	3
1970 TEST										
Endosulfan (2 lb/gal EC)	1.0									
+ parathion (1 lb/gal EC)	.5	7a	93	8a	86	0	100	77ab	2a	98
Esso ER 6624 (4 lb/gal EC)	1.0	7a	93	3a	94	0	100	70ab	2a	98
Esso ER 6622 (4 lb/gal EC)	1.0	6a	95	3a	93	0	100	75ab	1a	99
Fundal (97% SP)	.5	8a	92	3a	94	0	100	80a	1a	99
Galecron (4 lb/gal EC)	.5	11a	90	5a	91	0	100	80ab	1a	99
Mobil MC 3470 (1 lb/gal EC)	1.0	39a	64	7a	87	0	100	47c	5a	95
Resmethrin (10% WP)	.4	21a	80	6a	89	0	100	66b	2a	98
Phosvel (3 lb/gal EC)	.5	12a	88	7a	87	0	100	83a	0a	100
Phosvel (3 lb/gal EC)	1.0	19a	83	7a	87	0	100	78ab	2a	98
Untreated	-	108b	-	57b	-	10	-	0d	69b	31

¹ Values not having a letter in common are significantly different at the 5% level of significance, based on Duncan's multiple range test.

² Average number larvae and pupae per 100 plants found during 4 weekly counts. Data transformed to $\sqrt{x+0.5}$ for statistical analysis.

³ Data transformed to arc sin $\sqrt{x}$ for statistical analysis.

⁴ SP = soluble powder.

TABLE 2.—*Effectiveness of chemical insecticides in controlling caterpillars on the fall cabbage crop*¹

Insecticide and formulation	Dose, lb/ acre	Cabbage looper 2		Diamondback moth 2		Fall armyworm 2		% plants 3 in—		Marketable heads, %
		Number surviving	Reduction, %	Number surviving	Reduction, %	Number surviving	Reduction, %	Class 1 (uninjured)	Class 3 4 (damaged)	
1969 TEST										
Endosulfan (2 lb/gal EC)	1.0	1a	98	—	—	4a	78	85ab	0a	100
Endosulfan (2 lb/gal EC)	1.0	2a	93	—	—	0a	100	92ab	2a	98
+ parathion (1 lb/gal EC)	.5	1a	98	—	—	3a	83	81bc	4a	96
Fundal (97% SP) ⁵	.25	5a	86	—	—	5a	74	75c	5a	95
Galecron (4 lb/gal EC)	1.0	1a	98	—	—	1a	96	92ab	1a	99
Methomyl (90% SP)	.5	2a	93	—	—	0a	100	89ab	2a	98
Methomyl (90% SP)	.75	1a	98	—	—	0a	100	94a	0a	100
Monitor (4 lb/gal EC)	1.0	2a	93	—	—	1a	96	92ab	0a	100
Phosvel (3 lb/gal EC)	1.0	0a	100	—	—	2a	87	97a	0a	100
Shell SD 15289 (1.67 lb/gal EC)	—	37b	—	—	—	19b	—	21d	29b	71
Untreated	—	—	—	—	—	—	—	—	—	—
1970 TEST										
Endosulfan (2 lb/gal EC)	1.0	0a	100	0a	100	0a	100	97a	0a	100
+ parathion (1 lb/gal EC)	.5	2ab	96	0a	100	1a	90	94a	0a	100
Fundal (97% SP)	.5	5abc	91	2a	89	1a	90	88a	3ab	97
Galecron (4 lb/gal EC)	1.0	33e	41	0a	100	2a	80	63b	9b	91
Mobil MC 3470 (2 lb/gal EC)	.4	15d	73	1a	95	1a	90	87a	1a	99
Resmethrin (10% WP)	.5	11cd	80	2a	89	0a	100	90a	1a	99
Phosvel (3 lb/gal EC)	1.0	7bcd	87	0a	100	0a	100	91a	1a	99
Phosvel (3 lb/gal EC)	—	56f	—	19b	—	10b	—	21c	33c	67
Untreated	—	—	—	—	—	—	—	—	—	—

¹ Values not having a letter in common are significantly different at the 5% level of significance, based on Duncan's multiple range test.² Average number of larvae and pupae per 100 plants found during 3 weekly counts. Data transformed to $\sqrt{x+0.5}$ for statistical analysis.³ SP = soluble powder.⁴ Data transformed to arc sin $\sqrt{x}$ for statistical analysis.

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